



RuggedSwitch® RSG2200

9-Port Modular Managed Gigabit Ethernet Switch



Installation Guide

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This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference on his own expense.

CAUTION

This product contains a laser system and is classified as a “**CLASS 1 LASER PRODUCT**”

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Changes or modifications not expressly approved by RuggedCom Inc. could void the user's authority to operate the equipment.

Should this device require service see the “Warranty and Service” section of this guide.

IMPORTANT

This product should be installed in a **restricted access location** where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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3 Product Overview

3.1 Functional Overview

The RuggedSwitch® RSG2200 is an industrially hardened, fully managed, modular, Ethernet switch specifically designed to operate reliably in electrically harsh and climatically demanding utility substation and industrial environments. The RSG2200's superior ruggedized hardware design coupled with the RuggedSwitch® Operating System (ROS®) provides improved system reliability and advanced networking features making it ideally suited for creating Ethernet networks for mission-critical, real-time, control applications.

The RSG2200's modular flexibility offers 1000BaseX fiber and 10/100/1000BaseTX copper port combinations. Optional front or rear mount connectors make the RSG2200 highly versatile for any application and can support multiple fiber connectors (SFP, GBIC, LC, SC) without loss of port density. The RSG2200 is packaged in a rugged galvanized steel enclosure with industrial grade DIN, panel, or 19" rack mount mounting options.

3.2 Feature Highlights

Ethernet Ports

- Up to 9-Gigabit Ethernet ports supporting copper and fiber media
- Up to 9 100FX Fiber Fast Ethernet ports
- 2 port modules for tremendous flexibility
- Fiber types supported include multimode, singlemode, and bidirectional single strand
- Full compliance with IEEE: 802.3, 802.3u & 802.3z
- Non-blocking, store and forward switching
- Full duplex operation and flow control (IEEE 802.3x)
- Industry standard fiber optical connectors: LC, SC, SFP, GBIC
- Long haul optics allow Gigabit distances up to 70km

Cyber Security Features

- Multi-level user passwords
- SSH/SSL encryption
- MAC-based port security
- Selective port enable/disable
- Port-based network access control using IEEE 802.1x
- VLAN support (IEEE 802.1Q) to segregate and secure network traffic
- RADIUS centralized access management
- SNMPv3 featuring encrypted authentication and session

RuggedRated™ for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
 - Zero-Packet-Loss™ Technology
 - Meets IEEE 1613 Class 2 (electric utility substations)
 - Exceeds IEC 61850-3 (electric utility substations)
 - Exceeds IEEE 61800-3 (variable speed drive systems)
 - Exceeds IEC 61000-6-2 (generic industrial environment)
 - Exceeds NEMA TS-2 (traffic control equipment)
- -40 to +85°C operating temperature (no fans)
- Conformal coated printed circuit boards (optional)
- 18 AWG galvanized steel enclosure
- Hazardous Location Certification: Class 1 Division 2

Universal Power Supply Options

- Fully integrated, dual-redundant (optional) power supplies
- Universal high-voltage range: 88-300VDC or 85-264VAC
- Popular low voltage DC ranges: 12, 24 or 48 VDC
- Screw or pluggable terminal blocks for reliable, maintenance-free connections
- CSA/UL 60950 safety approved to +85°C

Rugged Operating System (ROS®) Networking Features

- Simple plug and play operation: automatic learning, negotiation, and crossover detection
- MSTP 802.1Q-2005 (formerly 802.1s)
- RSTP (Rapid Spanning Tree Protocol) support: IEEE 802.1w
- eRSTP™ (Enhanced Rapid Spanning Tree) support, <5ms network fault recovery
- QoS (Quality of Service) support: IEEE 802.1p, for real-time traffic
- VLAN (Virtual LAN) support: IEEE 802.1Q with double tagging
- GVRP (GARP VLAN Registration Protocol) support: IEEE 802.1D
- GMRP (GARP Multicast Registration Protocol) support: IEEE 802.1D
- Link Aggregation support: IEEE 802.3ad
- IGMP Snooping for multicast filtering
- Port rate limiting and broadcast storm limiting
- Port configuration, status, statistics, mirroring, security
- Loss of link management on fiber ports
- SNTP time synchronization (both client and server)
- Industrial automation features (e.g. Modbus)

Rugged Operating System (ROS®) Management Features

- Secure Web-based management interface
- Console menu and Command Line management interfaces via SSH, RSH, and Telnet
- SNMP v1, v2c, and v3
- RMON (Remote MONitoring)
- Rich set of diagnostics with logging and alarms

3.3 Mounting Flexibility

The RSG2000 series of products have been designed with maximum mounting and display flexibility. Customers can order an RSG2000 series switch that can be mounted in a standard 19" rack, 1" DIN Rail, or directly onto a panel. For rack mount installations, the RSG2000 series can be ordered with connectors on the front of the unit, or can be located on the rear of the chassis to allow for all data and power cabling to be installed and connected at the rear of the rack. See Figure 1 for rack mount orientation examples.

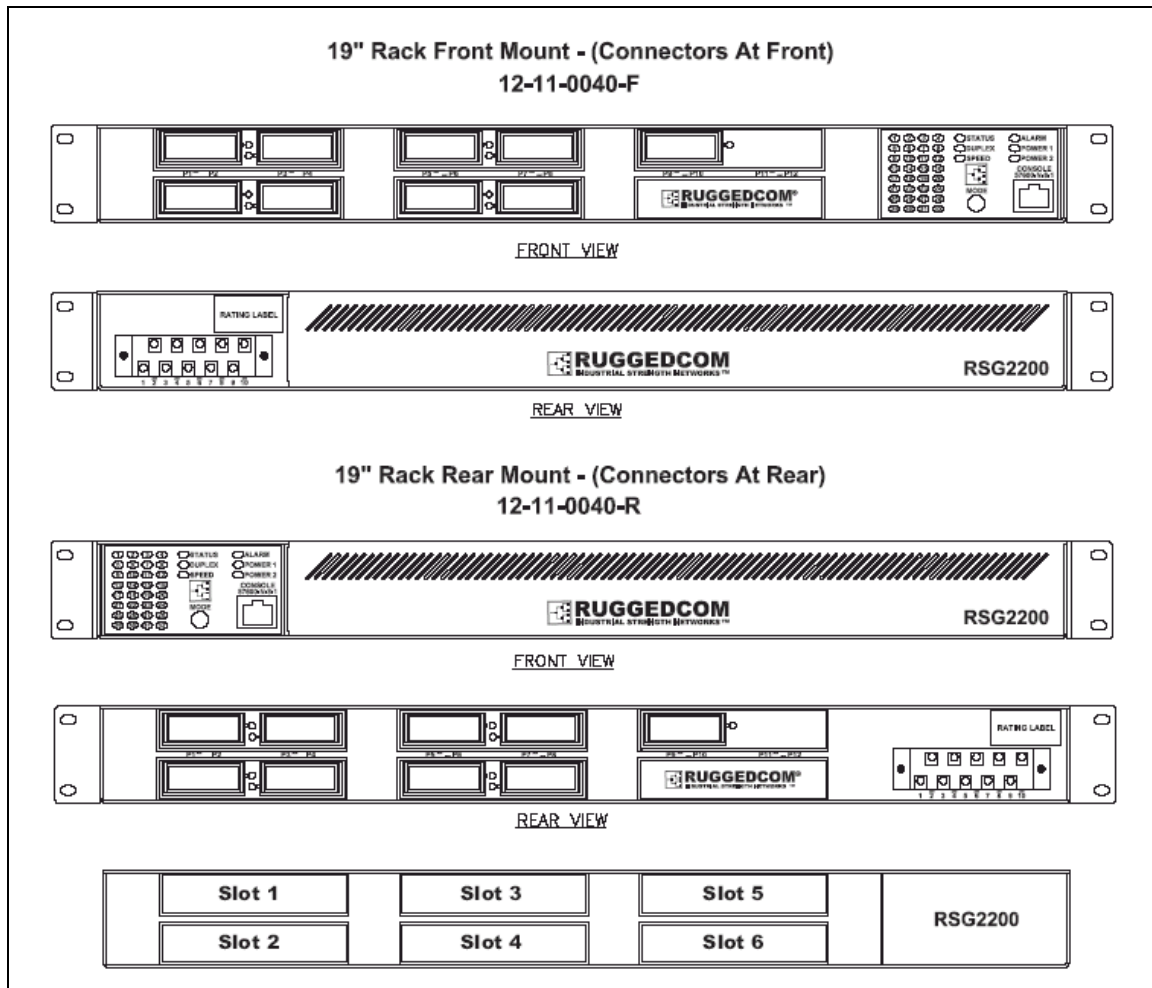


Figure 1: RSG2000 Rack mount chassis orientation options – Front and rear mount.

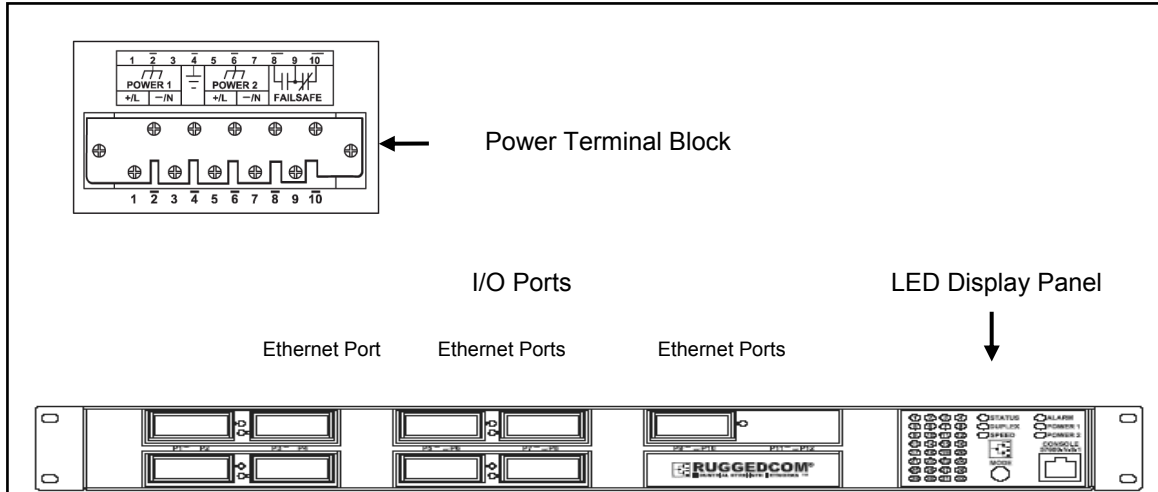


Figure 2: Ethernet, LED Status, and Power Panels

3.4 Ethernet Panel Description

Each Ethernet module is equipped with an LED per port that indicate link/activity status information. The LED will be solid for ports with link, and will blink for activity. The diagram in Figure 3 highlights the port and the associated link/activity LED.

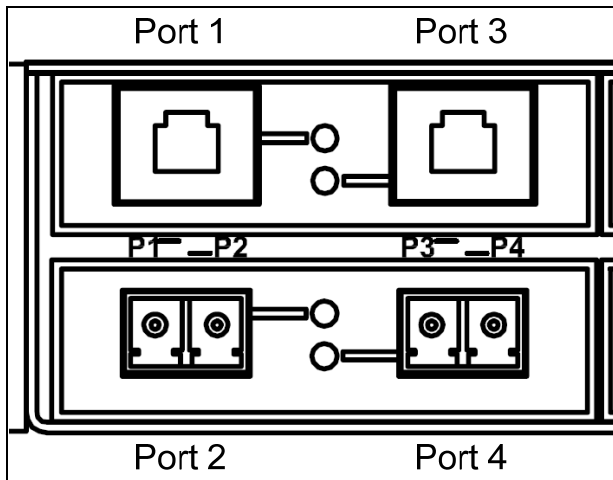


Figure 3: Ethernet panel LED description

3.4.1 Fiber Optical Transceiver Orientation and Connection

Depending on the order code of the product, the RSG2000 series products can be equipped with several different types of fiber optic ports. The Transmit (TX) and Receive (RX) connections of each port must be properly connected and matched for proper link and operation. Modules populated on the top row of the device typically have locking mechanisms or tabs towards the top of the unit. Modules located on the bottom row of the device have locking mechanisms or tabs towards the bottom of the device.

The drawings in the following figures show each fiber optical connector style with a side and top view to allow the user to identify the proper cable connection orientation. If modules are populated on the bottom row of the device, the transceiver orientation will be reversed (ie RX and TX will be reversed).

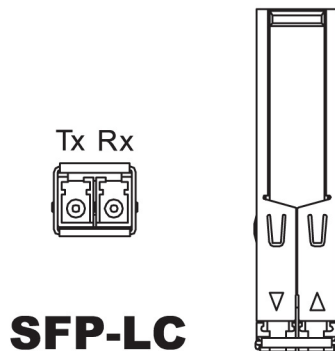


Figure 4: 1000LX SFP (mini-GBIC) Module and LC connector

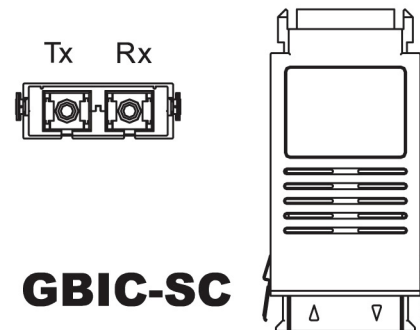


Figure 5: 1000LX GBIC connector

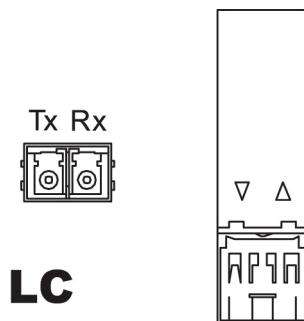


Figure 6: 1000LX LC connector

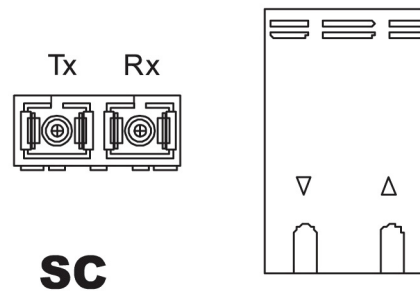


Figure 7: 1000LX SC connector

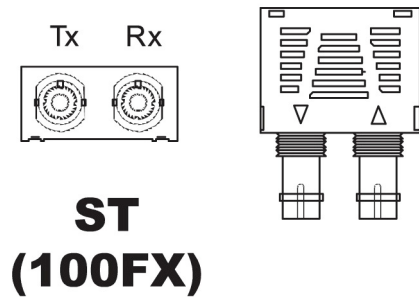


Figure 8: 100FX ST connector

3.5 Display Panel Description

The RSG2000 series products are equipped with a versatile display panel, shown in Figure 9, which is designed to provide quick status information for each port, as well as the entire device to allow for simple diagnostics and troubleshooting. It features:

- RS232 console port for 'out of band' console access and configuration
- Power supply and Alarm status indicators
- Convenient port status indicators conveying Link-Activity, Duplex, or Speed via push-button control.
- System reset via push-button if held for 5 seconds

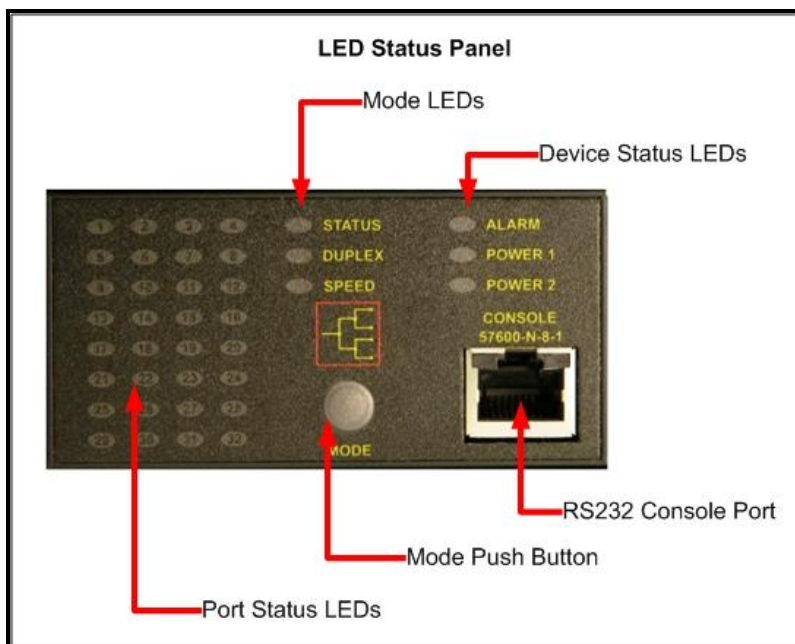


Figure 9: RSG2200 LED Display Panel

Device status LEDs exist to provide a quick visual indicator to operators for operational status of the unit. Table 1 defines the possible LED colours and the corresponding description.

| LED | Colour | Description |
|------------|---------------|---|
| PS1 / PS2 | Green | Power supply operating normal |
| | Red | Power supply failure |
| | Off | No power supply installed |
| Alarm | Red | Alarm exist – login to web management interface to determine alarm code |
| | Off | No alarms exist |

Table 1: LED Display – Device status LED behavior definition

The port-based LEDs can be cycled between three display modes: Status, Duplex, and Speed. Pushing the mode button causes the display mode to be cycled.

| Mode | Colour | Description |
|-------------|------------------|-----------------------|
| Status | Green (Solid) | Link |
| | Green (Blinking) | Activity |
| | Off | No link |
| Duplex | Green (Solid) | Full-Duplex operation |
| | Orange (Solid) | Half-Duplex operation |
| | Off | No link |
| Speed | Green (Blinking) | 1000Mb/s |
| | Green (Solid) | 100Mb/s |
| | Orange (Solid) | 10Mb/s |
| | Off | No link |

Table 2: Port Status LED behavior definition

4 Installation

4.1 Rack Mounting

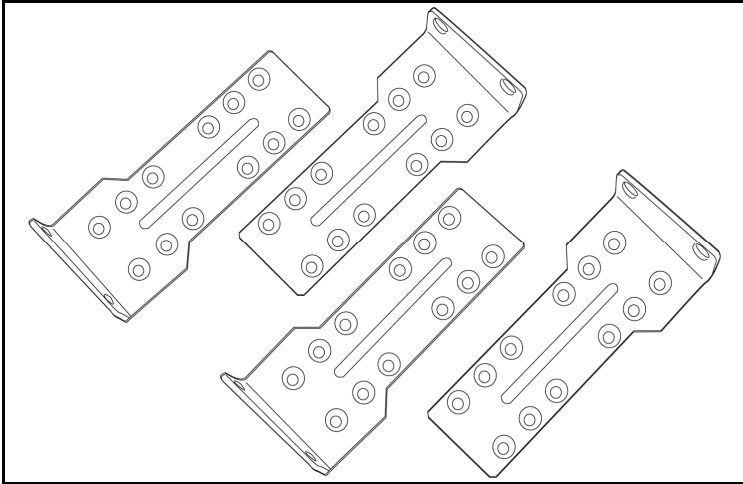


Figure 10: RSG2000 Family 19" Rack Mount Adapters

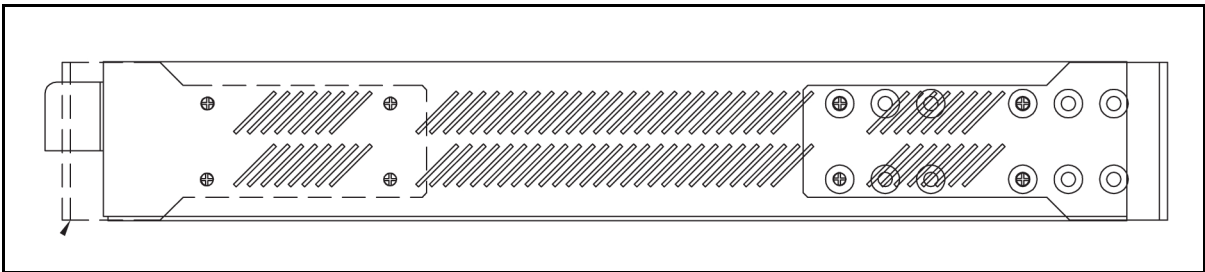


Figure 11: Rack mount adapter mounting location

The RSG2000 family of products can be rack mounted using the included rack mount adapter assemblies shown in Figure 10. Secure the rack mount adapter to the front side of the chassis using the included black PAN head Phillips screws in the positions shown in Figure 11. The entire chassis can then be mounted to a standard 19" rack. An additional two rack mount adapters are included to optionally secure the rear of the chassis in high-vibration, or seismically active locations.

Note: Since heat within the RS2000 is channeled to the enclosure, it is recommended that 1 rack-unit of space (1.75") be kept unpopulated and free of equipment above each RS2000 series product to allow for a small amount of convectional airflow. Although forced airflow is not necessary, any increase in airflow will result in a reduction of ambient temperature that will improve long-term reliability of all equipment mounted within the rack space.

4.2 Panel and DIN Rail Mounting

The RSG2200 series products can be ordered as a Panel/DIN mount chassis. Both options involve the use of the panel/DIN adapters to be mounted on each side of the chassis enclosure. The adapter allows for the chassis to be mounted on the standard 1" DIN rail using the grooves in the adapter, secured using the included Phillips screw. See Figure 12 for a PANEL/DIN mount diagram.

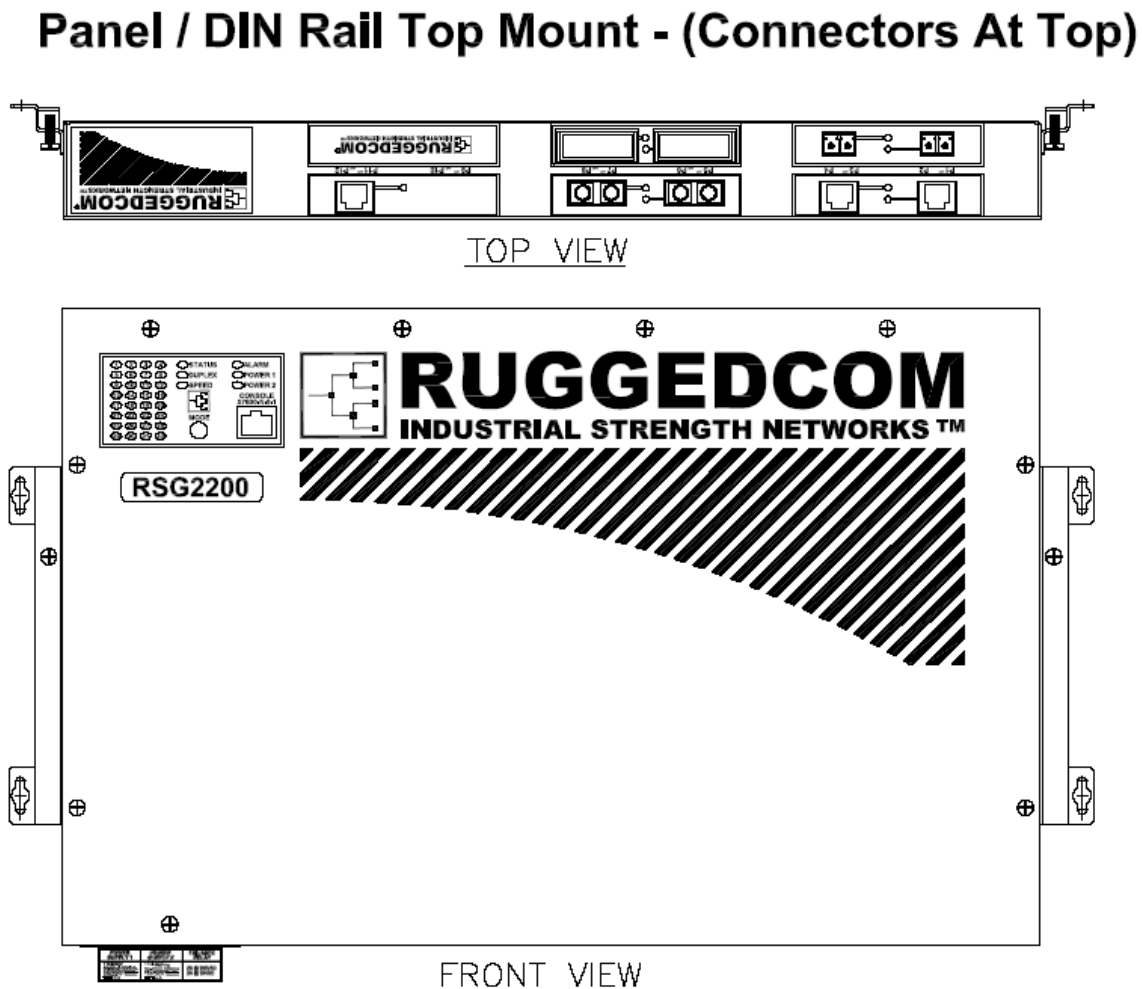


Figure 12: RSG2200 PANEL/DIN RAIL mounting diagram (connectors at top)

4.3 Power Supply Wiring and Grounding

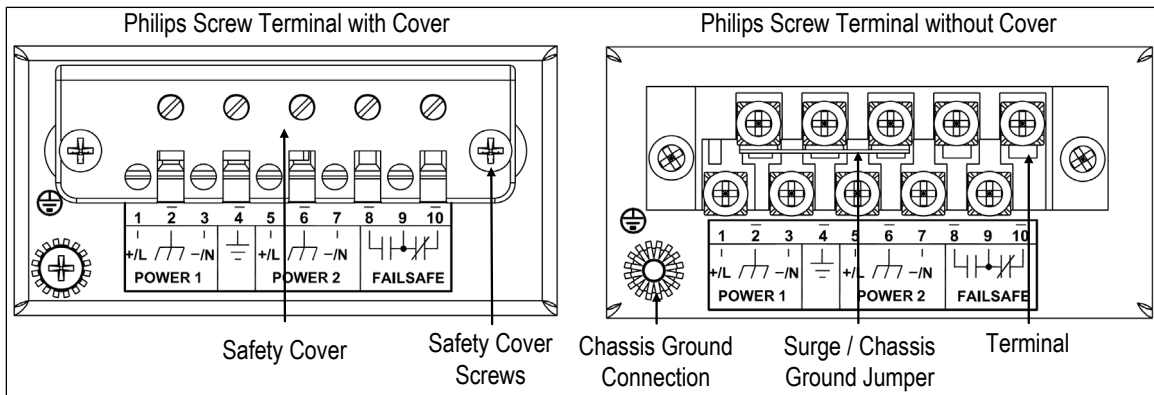


Figure 13: RSG2000 Series Phillips Screw Terminal Block

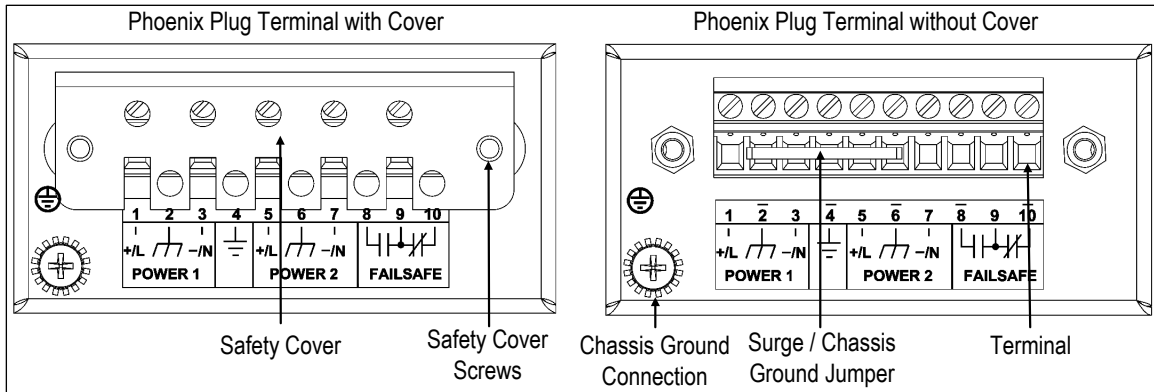


Figure 14: RSG2000 Series Phoenix Plug Terminal Block

The RSG2200 family supports dual redundant power supplies – “Power Supply 1 (PS1)” and “Power Supply 2 (PS2)”. The connections for PS1, PS2 and the fail-safe relay are located on the terminal block as shown in Figure 13 and Figure 14.

The RSG2000 Family chassis ground connection, shown in Figure 15, uses a #6-32 screw. It is recommended to terminate the ground connection in a #6 ring lug, and to use a torque setting not exceeding 15 in.lbs (1.7 Nm).

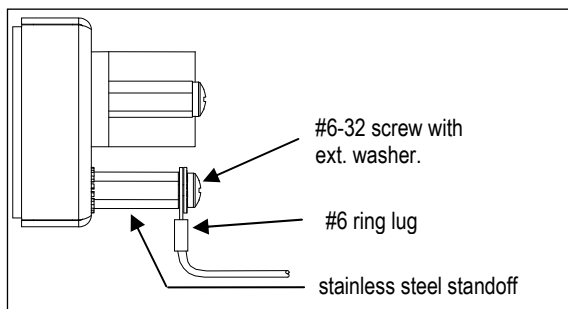


Figure 15: Chassis Ground Connection

The RSG2200 family can be equipped with either a Phillips Screw Terminal Block or a Phoenix Plug Terminal Block. The Phillips Screw Terminal Block has Phillips screws with a compression plate allowing either bare wire connections or crimped terminal lugs. We recommend the use of #6 size ring lugs to ensure secure, reliable connections under severe shock or vibration. Both terminal blocks have a safety cover which must be removed via two Phillips screws before connecting any wires. The safety cover must be re-attached after wiring to ensure personnel safety. Refer to Table 3 below for a description of each terminal as well as sections 4.3.1 through 4.3.3 for wiring examples.

| Terminal # | Description | Usage |
|-------------------|--------------------|---|
| 1 | PS1 Live / + | PS1 Live / + is connected to the positive (+) terminal if the power source is DC or to the (Live) terminal if the power source is AC. |
| 2 | PS1 Surge Ground | PS1 Surge Ground is connected to the Chassis Ground via a jumper on the terminal block. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry. NOTE: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing. |
| 3 | PS1 Neutral / - | PS1 Neutral / - is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC. |
| 4 | Chassis Ground | Chassis Ground is connected to the Safety Ground terminal for AC inputs or the equipment <i>ground bus</i> for DC inputs. Chassis ground connects to both power supply surge grounds via a removable jumper. |
| 5 | PS2 Live / + | PS2 Live / + is connected to the positive (+) terminal if the power source is DC or to the (Live) terminal if the power source is AC. |
| 6 | PS2 Surge Ground | PS2 Surge Ground is connected to the Chassis Ground via a jumper on the terminal block. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry. NOTE: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing. |
| 7 | PS2 Neutral / - | PS2 Neutral / - is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC. |
| 8 | Relay NO Contact | Normally open, failsafe relay contact. |
| 9 | Relay Common | Failsafe relay common contact. |
| 10 | Relay NC Contact | Normally closed, failsafe relay contact. |

Table 3: RSG2200 Power terminal block connection description

4.3.1 AC Power Supply Wiring Examples

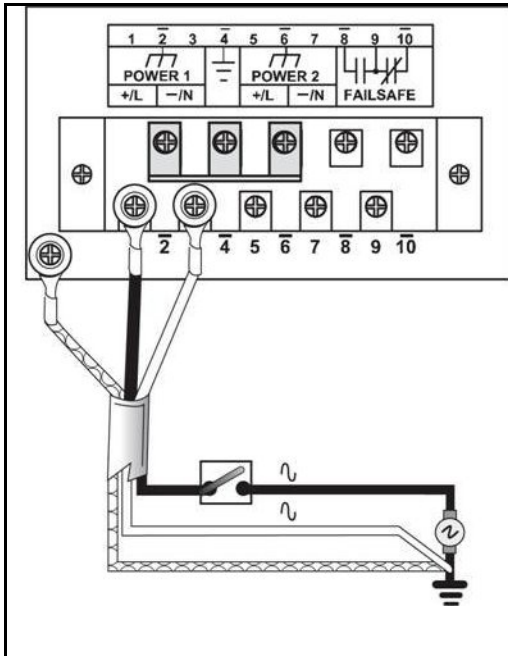


Figure 16: AC Single Power Supply Wiring Example

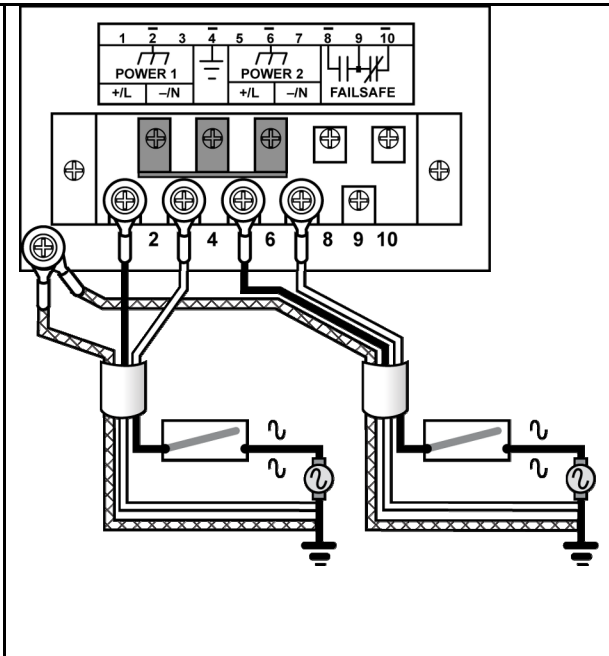
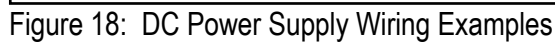


Figure 17: AC Dual Redundant Power Supply Wiring Example

Notes:

1. **100-240VAC rated equipment: A 250VAC appropriately rated circuit breaker must be installed.**
2. **Equipment must be installed according to the applicable country wiring codes.**
3. **When equipped with two HI voltage power supplies, independent AC sources can be used to power the product for greater redundancy.**



- 1. 125/250VDC rated equipment: A 300VDC appropriately rated circuit breaker must be installed.**
- 2. A circuit breaker is not required for 12, 24 or 48 VDC rated power supplies.**
- 3. For dual DC power supplies, Separate circuit breakers must be installed and separately identified.**
- 4. Equipment must be installed according to the applicable country wiring codes.**

4.3.3 Dual Power Supplies – DC and AC Inputs

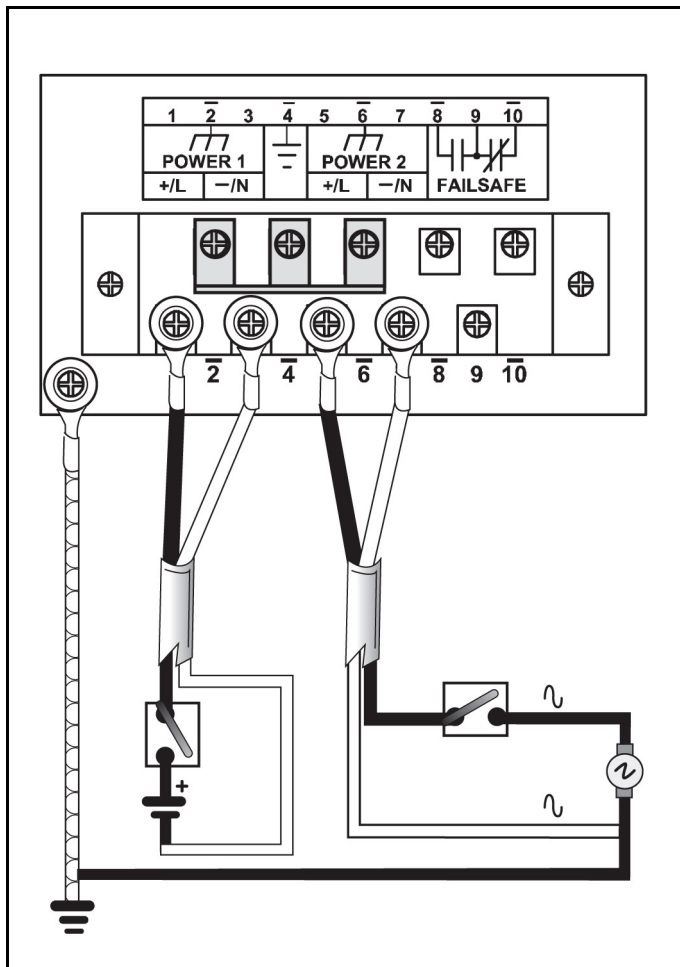


Figure 19: DC and AC Power Supply Wiring Examples

Notes:

1. **125/250VDC rated equipment:** A 300VDC appropriately rated circuit breaker must be installed.
2. **100-240VAC rated equipment:** A 250VAC appropriately rated circuit breaker must be installed.
3. A circuit breaker is not required for 12, 24 or 48 VDC rated power supplies.
4. Separate circuit breakers must be installed and separately identified.
5. Equipment must be installed according to the applicable country wiring codes.

4.4 Dielectric Strength (HIPOT) Testing

For dielectric strength (HIPOT) testing in the field, users must remove the metal jumper located on terminal 2, 4, and 6 of the power supply terminal block. This metal jumper connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during HIPOT testing. Figure 20 shows the proper HIPOT test connections and should be followed to avoid damage to the device.

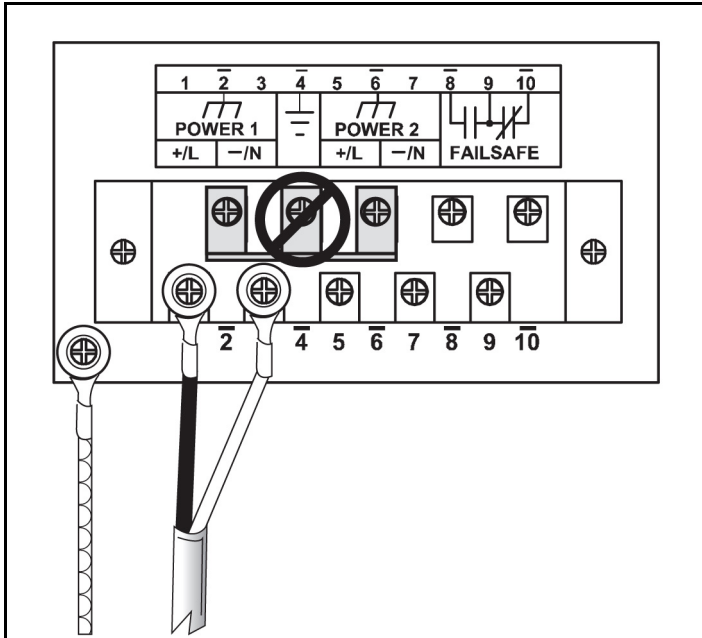


Figure 20: Dielectric Strength (HIPOT) Testing

4.5 Failsafe Alarm Relay Wiring and Specifications

The “Failsafe” output relay is provided to signal critical error conditions that may occur on the RSG2200 series products. The contacts are energized upon power up of the unit and remain energized until a critical error occurs. The proper relay connections are shown in Figure 21. Control of the output is user selectable and can be programmed via the Rugged Operating System (ROS). One common application for this output is to signal an alarm if a power failure or removal of control power occurs.

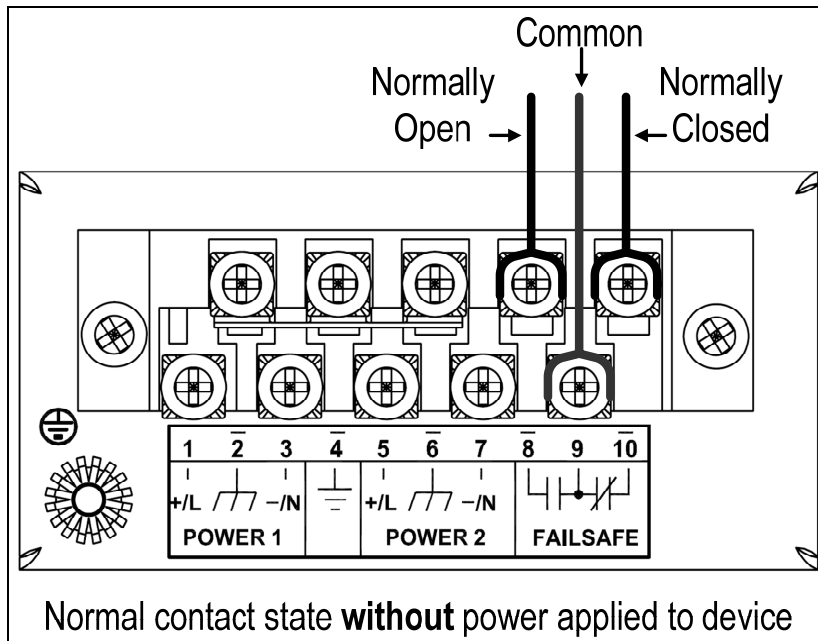


Figure 21: Failsafe Alarm Relay Wiring

4.6 Console Port Wiring

A RS232 console port for configuration and management of the device is located on the LED display module shown in Figure 22. This port is intended to be a temporary connection during initial configuration or troubleshooting and allows for direct access to the serial-based management console. The connection is made using the DB9-Female to RJ45 console cable included in the device packaging shown in Figure 23. Console connection settings are: 57600 baud, no parity bits, 8 data bits, and 1 stop bit.

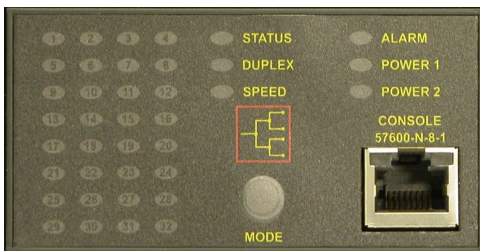


Figure 22: Console port location on display board

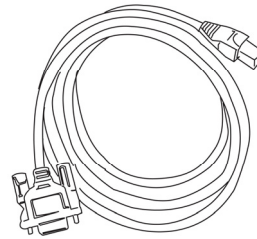


Figure 23: RSG2200 Console cable

For user reference, the console cable pin-out is show in Table 5.

| <i>RuggedCom RS232 over RJ45 pin-out specification</i> | | |
|---|---------------------------|-------------------------|
| <i>Signal Name (PC is DTE)</i> | <i>DB9- Female</i> | <i>RJ45 Male</i> |
| DCD – Carrier detect | 1 | 2 |
| RxD – Receive data (to DTE) | 2 | 5 |
| TxD – Transmit data (from DTE) | 3 | 6 |
| DTR – Data terminal ready | 4 | 3 |
| Signal GND | 5 | 4 |
| DSR – Data set ready | 6 | 1* |
| RTS – Ready to send | 7 | 8 |
| CTS – Clear to send | 8 | 7 |
| RI – Ring Indicator | 9 | 1* |

Table 4: RS232 over RJ45 console cable pin-out

After initial configuration, the device can be configured via a number of new mechanisms such as Telnet, SSH and the built-in web server. Consult the ROS® User Guide for further details.

NOTE: This port is not intended to be a permanent connection and the cable shall be less than 2m (6.5 ft) in length.

4.7 Ethernet Ports

4.7.1 RJ45 Twisted-Pair Data Ports

RS2000 series Ethernet switches are equipped with at least 24 10/100BaseTX ports that allow connection to standard CAT-5 UTP cable with RJ45 male connectors. All RS2000 series RJ45 RuggedSwitch products feature auto-negotiation, auto-polarity, and auto-crossover functions. The RJ45 receptacles can also accept and take advantage of screened (commonly known as “shielded”) cabling. Figure 24 shows the RJ45 port pins configuration.

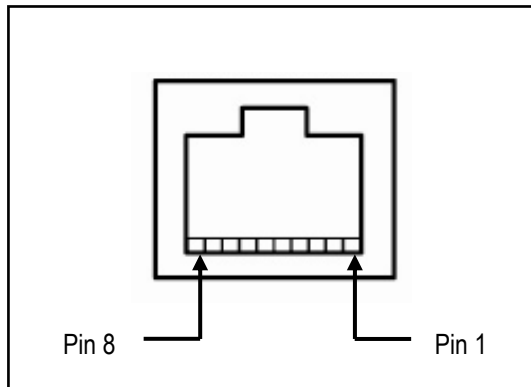


Figure 24: RJ45 port pin configuration.

| 10/100BaseTx Pin-out | |
|-----------------------------|--------------------|
| <i>Pin</i> | <i>Description</i> |
| 1 | RX + |
| 2 | RX - |
| 3 | TX + |
| 6 | TX - |
| 4, 5, 7, 9 | NC |

Table 5: RJ45 Ethernet pin assignment

4.7.2 Gigabit Ethernet 1000Base-TX Cabling Recommendations

The IEEE 802.3ab Gigabit Ethernet standard defines 1000 Mbit/s Ethernet communications over distances of up to 100 meters using 4 pairs of category 5 (or higher) balanced unshielded twisted-pair cabling. For wiring guidelines, system designers and integrators should refer to the Telecommunications Industry Association (TIA) TIA/EIA-568-A wiring standard that characterizes minimum cabling performance specifications required for proper Gigabit Ethernet operation. To ensure reliable, error-free data communications, new and pre-existing communication paths should be verified for TIA/EIA-568-A compliance. Table 6 summarizes cabling standards available today

| Cabling Category | 1000BaseTx Compliant | Required action |
|-------------------------|-----------------------------|--|
| < 5 | No | New wire infrastructure required |
| 5 | Yes | Verify TIA/EIA-568-A compliance |
| 5e | Yes | No action required. New installations should be designed with Category 5e components or higher |
| 6 | Yes | No action required |
| > 6 | Yes | Connector and cabling standards to be determined. |

Table 6: Cabling categories and 1000BaseTx compliance defined.

In general the following recommendations should be followed for copper data cabling in high electrical noise environments:

- Data cable lengths should be as short as possible, ideally limited to 3m (10ft) in length. Copper data cables should not be used for inter-building communications.
- Power and data cables should not be run in parallel for long distances, and ideally should be installed in separate conduits. Power and data cables should intersect at 90° angles when necessary to reduce inductive coupling.
- Shielded/screened cabling can optionally be used. The cable shield should be grounded at one single point to avoid the generation of ground loops.

NOTE: RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic. RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

4.8 Pluggable optics – Installation, removal, and precautions

The RSG2000 series of products can be ordered with pluggable optic form factors such as SFP (Small Form-factor Pluggable) or GBIC (Gigabit Interface Converter) modules. These modules can be safely inserted and removed while the chassis is powered and operating – this feature is also known as “hot-swappable”. When inserting or removing optics there are several precautions that should be taken. They include:

- Ensuring that dust caps are mounted on SFP cages at all times unless a user is in the process of inserting or removing an SFP module. The dust caps will prevent the accumulation of residue or particles that may inhibit proper operation.
- Ensuring that the user has properly discharged any possible electrostatic build-up and electrostatic discharges (ESD). This can be accomplished by properly user ‘grounding’ via an ESD wrist strap, or by touching earth or chassis ground before performing installation or removal of optics. ESD can damage or shorten the life of optical modules when not plugged into a chassis.
- SFP and GBIC optical modules should always be stored in an ESD safe bag or other suitable ESD safe environment, free from moisture and stored at proper storage temperature (–40 to +85°C).
- Disconnecting all cables from SFP or GBIC module before insertion or removal of module.
- Only RuggedCom Inc. certified optics should be used on RuggedCom products. Damage can occur to optics and product if compatibility and reliability have not been properly assessed.

4.8.1 Module Insertion – GBICs and SFPs

To insert GBICs or SFPs, special attention should be taken into the proper module orientation. Refer to Figure 25 for proper module orientation, as ports on the upper row of the product require optics to be inserted topside-up, and ports on the lower row of the product require modules to be inserted topside-down. GBICs should be inserted with module dust cover in place. SFPs should be inserted with dust cover in place, and the bail-latch in the locked position. Module should gently slide into port and should lock in place when module is fully inserted. To protect optics, dust covers should always be installed when cables are not connected.

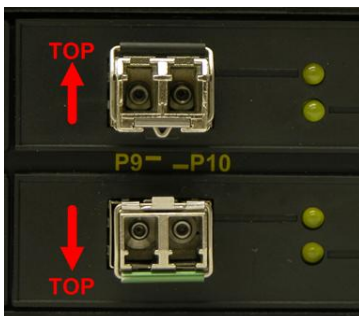


Figure 25: SFP Orientation for top row and bottom row ports

4.8.2 GBIC Module Removal

GBIC Modules have two locking latches on either side of the module shown in Figure 26. To remove GBIC module, disconnect any cable and replace with dust cover to protect the optics. User should depress both latches simultaneously and gently pull the module from the chassis. The module should be immediately stored in an ESD-safe environment.

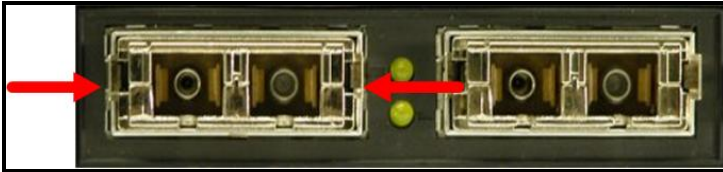


Figure 26: Locking latch location on GBIC optical modules

4.8.3 SFP Module Removal

SFP Modules are removed using the metal bail latch located on the top of the module shown in Figure 27. To remove the SFP module, disconnect any cable and replace with dust cover to protect the optics. User should grasp bail latch and gently pull outwards to unlock and remove the SFP module. Removal of the SFP module is shown further in Figure 28. The module should be immediately stored in an ESD-safe environment.



Figure 27: SFP Bail Latch location



Figure 28: SFP Removal

5 Technical Specifications

5.1 Power Supply Specifications

| Power Supply Type | Input Range | | Internal Fuse Rating | Max. Power Consumption ³ |
|--|------------------|--------------------|-----------------------|-------------------------------------|
| | Min | Max | | |
| 12 – 24 VDC | 10 VDC | 36 VDC | 6.3A(F) ² | 22W |
| 48 VDC | 36 VDC | 59 VDC | 3.15A(T) ² | |
| HI (125/250 VDC) ¹ HI (110/230 VAC) ¹ | 88 VDC 85 VAC | 300 VDC 264 VAC | 2A(T) ^{1,2} | |

NOTES:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse.
3. Power consumption varies based on configuration. 10/100Base-TX ports consume roughly 1W less than fiber optic ports.

5.2 Failsafe Relay Specifications

| Parameter | Value (Resistive Load) |
|-------------------------|---|
| Max Switching Voltage | 240VAC, 125VDC |
| Rated Switching Current | 2A @ 240VAC 0.15A @ 125VDC, 2A @ 30VDC |
| Max Switching Capacity | 150W, 500VA |

5.3 Networking Standards Supported

| Parameter | 10Mbps Ports | 100Mbps Ports | 1000Mbps Ports | Notes |
|--------------|--------------|---------------|----------------|-----------------------|
| IEEE 802.3 | | | | 10BaseT / 10BaseFL |
| IEEE 802.3u | | | | 100BaseTX / 100BaseFX |
| IEEE 802.3z | | | ✓ | 1000BaseSX/LX |
| IEEE 802.3ab | | | ✓ | 1000BaseTx |
| IEEE 802.3x | ✓ | ✓ | ✓ | Full Duplex Operation |
| IEEE 802.1D | ✓ | ✓ | ✓ | MAC Bridges |
| IEEE 802.1Q | ✓ | ✓ | ✓ | VLAN (Virtual LAN) |
| IEEE 802.1p | ✓ | ✓ | ✓ | Priority Levels |

5.4 Copper Ethernet Port Specifications

The RSG2200 can be ordered with two-port 10/100/1000Tx modules in slots 1, 2, 3, and 4, and a one-port 10/100/1000Tx module in 5. All copper ports have the following specifications:

| Parameter | Specification | Notes |
|-----------------|------------------|-------------------------------|
| Speed | 10/100/1000 Mbps | Auto-negotiating |
| Duplex | FDX / HDX | Auto-negotiating |
| Cable-Type | > Category 5 | Shielded/Unshielded |
| Wiring Standard | TIA/EIA T568A/B | Auto-Crossover, Auto-Polarity |
| Max Distance | 100m | |
| Connector | RJ45 | |
| Isolation | 1.5kV | RMS 1-minute |

5.5 Fiber Optic Specifications

The following sections detail fiber optic specifications on ports that can be ordered with a RSG2200 series Ethernet switch. The user determines the type of optics at time of ordering, and can determine the modules installed on a particular unit by reading the factory data file via the RuggedSwitch ROS® user interface. The following sections detail specifications of fiber optic modules in Gigabit Ethernet (1000Mbps).

5.6 Fiber Ethernet Port Specifications

Sections 5.6.1 and 5.6.2 list specifications of the optical transceivers used in the fiber Ethernet modules available for the RSG2200. The specifications are organized by signaling speed and then by order code. Module order codes are contained within each product when assembled and configured at the factory. Consult the RuggedCom ROS® User Guide for help in obtaining the factory configuration data.

5.6.1 Fast Ethernet (10/100Mbps) Optical Specifications

| Order Code | Mode | Connector Type | Cable Type (um) | Tx λ (typ.) (nm) | Tx min (dBm) | Tx max (dBm) | Rx Sensitivity (dBm) | Rx Saturation (dBm) | Distance (typ.) (km) | Power Budget (dB) |
|------------|------|----------------|-----------------|------------------|--------------|--------------|----------------------|---------------------|----------------------|-------------------|
| FXA01 | MM | ST | 62.5/125 | 1308 | -19 | -14 | -31 | -14 | 2 | 12 |
| | | | 50/125 | | -22.5 | | | | | 8.5 |
| FXA02 | MM | SC | 62.5/125 | 1308 | -19 | -14 | -31 | -14 | 2 | 12 |
| | | | 50/125 | | -22.5 | | | | | 8.5 |
| FXA11 | MM | LC | 62.5/125 | 1310 | -19 | -14 | -32 | -14 | 2 | 13 |
| FXA03 | MM | MTRJ | 62.5/125 | 1308 | -19 | -14 | -31 | -14 | 2 | 12 |
| | | | 50/125 | | -22.5 | | | | | 8.5 |
| FXA04 | SM | ST | 9/125 | 1310 | -15 | -8 | -32 | -3 | 20 | 17 |
| FXA05 | SM | SC | 9/125 | 1300 | -15 | -8 | -31 | -7 | 20 | 16 |
| FXA06 | SM | LC | 9/125 | 1310 | -15 | -8 | -34 | -7 | 20 | 19 |
| FXA07 | SM | SC | 9/125 | 1310 | -5 | 0 | -34 | -3 | 50 | 29 |
| FXA08 | SM | LC | 9/125 | 1310 | -5 | 0 | -35 | -3 | 50 | 30 |
| FXA09 | SM | SC | 9/125 | 1310 | 0 | 5 | -37 | 0 | 90 | 37 |
| FXA10 | SM | LC | 9/125 | 1310 | 0 | 5 | -37 | 0 | 90 | 37 |

5.6.2 Gigabit Ethernet (1000Mbps) Optical Specifications

5.6.2.1 Fixed Gigabit Transceivers

| Order Code | Mode | Connector Type | Cable Type (um) | Tx λ (typ.) (nm) | Tx min (dBm) | Tx max (dBm) | Rx Sensitivity (dBm) | Rx Saturation (dBm) | Distance (typ.) (km) | Power Budget (dB) |
|------------|------|----------------|-----------------|--------------------------|--------------|--------------|----------------------|---------------------|----------------------|-------------------|
| FG01 | MM | LC | 50/125 | 850 | -9 | -2.5 | -20 | 0 | 0.5 | 11 |
| | | | 62.5/125 | | | | | | | |
| FG02 | SM | SC | 9/125 | 1310 | -10 | -3 | -20 | -3 | 10 | 10 |
| FG03 | SM | LC | 9/125 | 1310 | -9.5 | -3 | -21 | -3 | 10 | 11.5 |
| FG04 | SM | SC | 9/125 | 1310 | -5 | 0 | -20 | -3 | 25 | 15 |
| FG05 | SM | LC | 9/125 | 1310 | -7 | -3 | -24 | -3 | 25 | 17 |

5.6.2.2 SFP Gigabit Transceivers

| Order Code | Mode | Connector Type | Cable Type (um) | Tx λ (typ.) (nm) | Tx min (dBm) | Tx max (dBm) | Rx Sensitivity (dBm) | Rx Saturation (dBm) | Distance (typ.) (km) | Power Budget (dB) |
|-------------------|------|----------------|-----------------|--------------------------|--------------|--------------|----------------------|---------------------|----------------------|-------------------|
| F51 ³ | MM | LC | 50/125 | 850 | -9 | -2.5 | -20 | 0 | 0.5 | 11 |
| | | | 62.5/125 | | | | | | 0.3 | |
| FG52 | SM | LC | 9/125 | 1310 | -9.5 | -3 | -19 | -3 | 10 | 9.5 |
| FG53 | SM | LC | 9/125 | 1310 | -7 | -3 | -23 | -3 | 25 | 16 |
| FG54 ⁴ | SM | LC | 9/125 | 1550 | 0 | 5 | -23 | -3 | 70 | 23 |

5.6.2.3 GBIC Gigabit transceivers

| Order Code | Mode | Connector Type | Cable Type (um) | Tx λ (typ.) (nm) | Tx min (dBm) | Tx max (dBm) | Rx Sensitivity (dBm) | Rx Saturation (dBm) | Distance (typ.) (km) | Power Budget (dB) |
|-------------------|------|----------------|-----------------|--------------------------|--------------|--------------|----------------------|---------------------|----------------------|-------------------|
| FG71 | SM | SC | 9/125 | 1310 | -9.5 | -3 | -21 | -3 | 10 | 11.5 |
| FG72 | SM | SC | 9/125 | 1310 | -7 | -3 | -24 | -3 | 25 | 17 |
| FG73 ⁵ | SM | SC | 9/125 | 1550 | 0 | 5 | -23 | -3 | 70 | 23 |

Notes:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. All optical power figures are listed as dBm averages.
3. F51 transceivers are rated for -10 to +85°C
4. FG54 transceivers are rated for 0 to +70°C
5. FG73 transceivers are rated for -25 to +85°C

5.7 Operating Environment

| Parameter | Range | Comments |
|-------------------------------|--------------|---|
| Ambient Operating Temperature | -40 to 85°C | Ambient Temperature as measured from a 30cm radius surrounding the center of the enclosure. |
| Ambient Relative Humidity | 5% to 95% | Non-condensing |
| Ambient Storage Temperature | -40 to 85°C | |

5.8 Mechanical Specifications

| Parameter | Value | Comments |
|------------|---|--|
| Dimensions | 18.29 x 12.14 x 1.75 inches (464.57) x (308.36) x (44.45) mm | (Length x Width x Height) with mounting brackets installed |
| Weight | 10 lb (4.5 Kg) | |
| Enclosure | 18awg galvanized steel | |

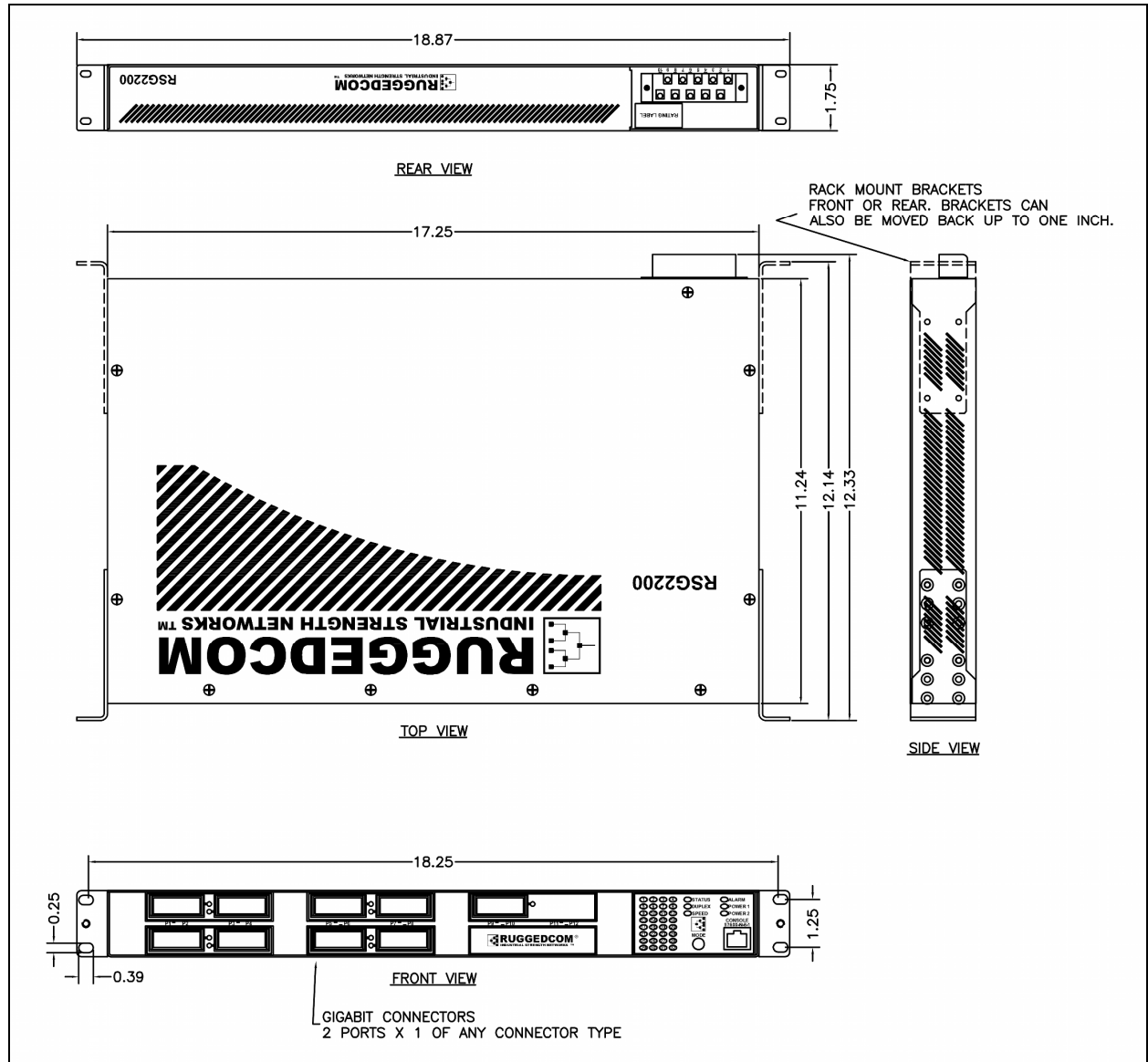


Figure 29: RSG2200 Series Mechanical Dimensions

6 Type Tests

6.1.1 IEC 61850-3 Type Tests

| Test | Description | | Test Levels | Severity Levels |
|----------------|--|--------------------|---|-----------------|
| IEC 61000-4-2 | ESD | Enclosure Contact | +/- 8kV | 4 |
| | | Enclosure Air | +/- 15kV | 4 |
| IEC 61000-4-3 | Radiated RFI | Enclosure ports | 20 V/m | Note 1 |
| IEC 61000-4-4 | Burst (Fast Transient) | Signal ports | +/- 4kV @ 2.5kHz | Note 1 |
| | | D.C. Power ports | +/- 4kV | 4 |
| | | A.C. Power ports | +/- 4kV | 4 |
| | | Earth ground ports | +/- 4kV | 4 |
| IEC 61000-4-5 | Surge | Signal ports | +/- 4kV line-to-earth, +/- 2kV line-to-line | 4 |
| | | D.C. Power ports | +/- 2kV line-to-earth, +/- 1kV line-to-line | 3 |
| | | A.C. Power ports | +/- 4kV line-to-earth, +/- 2kV line-to-line | 4 |
| IEC 61000-4-6 | Induced (Conducted) RFI | Signal ports | 10V | 3 |
| | | D.C Power ports | 10V | 3 |
| | | A.C. Power ports | 10V | 3 |
| | | Earth ground ports | 10V | 3 |
| IEC 61000-4-8 | Magnetic Field | Enclosure ports | 40 A/m continuous, 1000 A/m for 1 s | Note 1 |
| | | | 1000 A/m for 1 s | 5 |
| IEC 61000-4-29 | Voltage Dips & Interrupts | D.C. Power ports | 30% for 0.1s, 60% for 0.1s, 100% for 0.05s | N/A |
| IEC 61000-4-11 | | A.C. Power ports | 30% for 1 period, 60% for 50 periods | N/A |
| | 100% for 5 periods, 100% for 50 periods ² | | N/A | |
| IEC 61000-4-12 | Damped Oscillatory | Signal ports | 2.5kV common, 1kV differential mode @ 1MHz | 3 |
| | | D.C. Power ports | 2.5kV common, 1kV differential mode @ 1MHz | 3 |
| | | A.C. Power ports | 2.5kV common, 1kV differential mode @ 1MHz | 3 |
| IEC 61000-4-16 | Mains Frequency Voltage | Signal ports | 30V Continuous, 300V for 1s | 4 |
| | | D.C. Power ports | 30V Continuous, 300V for 1s | 4 |
| IEC 61000-4-17 | Ripple on D.C. Power Supply | D.C. Power ports | 10% | 3 |
| IEC 60255-5 | Dielectric Strength | Signal ports | 2kV AC (Fail-Safe Relay output) | N/A |
| | | D.C. Power ports | 1.5kV DC | N/A |
| | | A.C. Power ports | 2kV AC | N/A |
| IEC 60255-5 | H.V. Impulse | Signal ports | 5kV (Fail-Safe Relay output) | N/A |
| | | D.C. Power ports | 5kV | N/A |
| | | A.C. Power ports | 5kV | N/A |

Table 7 - IEC 61850-3 Type Tests

6.1.2 IEEE 1613 Type Tests

| IEEE Test | IEEE 1613 Clause | Description | | Test Levels |
|-----------|------------------|---------------------|--------------------|--|
| C37.90.3 | 9 | ESD | Enclosure Contact | +/- 2kV , +/- 4kV , +/- 8kV |
| | | | Enclosure Air | +/- 4kV , +/- 8kV , +/- 15kV |
| C37.90.2 | 8 | Radiated RFI | Enclosure ports | 35 V/m |
| C37.90.1 | 7 | Fast Transient | Signal ports | +/- 4kV @ 2.5kHz |
| | | | D.C. Power ports | +/- 4kV |
| | | | A.C. Power ports | +/- 4kV |
| | | | Earth ground ports | +/- 4kV |
| C37.90.1 | 7 | Oscillatory | Signal ports | 2.5kV common mode @ 1MHz |
| | | | D.C. Power ports | 2.5kV common, 1kV differential mode @ 1MHz |
| | | | A.C. Power ports | 2.5kV common, 1kV differential mode @ 1MHz |
| C37.90 | 6 | H.V. Impulse | Signal ports | 5 kV (Failsafe Relay) |
| | | | D.C. Power ports | 5 kV |
| | | | A.C. Power ports | 5 kV |
| C37.90 | 6 | Dielectric Strength | Signal ports | 2kV AC |
| | | | D.C. Power ports | 1.5kV DC |
| | | | A.C. Power ports | 2kV AC |

Table 8 - IEEE 1613 Type Tests

Notes:

- If the unit contains copper ports the IEEE 1613 conformance is Class 1 (During disturbance errors may occur but recovery is automatic).
- If the unit contains all fiber ports the IEEE 1613 conformance is Class 2 (During disturbance no errors will occur).

6.1.3 IEC Environmental Type Tests

| Test | Description | | Test Levels |
|----------------|------------------------------|---------|--------------------------------------|
| IEC 60068-2-1 | Cold Temperature | Test Ad | -40 deg. C, 16 Hours |
| IEC 60068-2-2 | Dry Heat | Test Bd | +85 deg. C, 16 Hours |
| IEC 60068-2-30 | Humidity (Damp Heat, Cyclic) | Test Db | 95% (non-condensing), 55°C, 6 cycles |
| IEC 60255-21-1 | Vibration | | 2g @ (10-150) Hz |
| IEC 60255-21-2 | Shock | | 30g @ 11 ms |

Table 9 - Environmental Type Tests

Note:

1. Ruggedcom specified security levels
2. Meets Class 2 requirements for an all fiber configuration. Class 1 for copper ports.

7 Agency Approvals

| Agency | Standards | Comments |
|---------------|-------------------------------------|---|
| CSA | CSA C22.2 No. 60950, UL 60950 | Passed |
| CE | EN 60950, EN 61000-6-2 | CE Compliance is claimed via Declaration of Self Conformity Route |
| FCC | FCC Part 15, Class A | Passed |
| CISPR | EN55022, Class A | Passed |
| FDA/CDRH | 21 CFR Chapter 1, Subchapter J | Passed |
| IEC/EN | EN60825-1:1994 + A11:1996 + A2:2001 | Passed |

8 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit <http://www.ruggedcom.com/> or contact your customer service representative.

Should this product require warranty or service contact the factory at:

RuggedCom Inc.

300 Applewood Crescent

Concord, Ontario

Canada L4K 5C7

Phone: +1 905 856 5288

Fax: +1 905 856 1995